

Appln. No. 10/005,576
Amdt. dated March 31, 2004
Reply to Office Action of February 24, 2004

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (currently amended) In a sheet lifter and separator for lifting and separating the uppermost sheet of a stack of workpieces from the sheet disposed therebelow, the combination comprising:

(a) a lifter including a frame and a multiplicity of suction holders spaced thereabout with working surfaces at their lower ends to engage the sheet, and
a separator frame pivotably mounted on said lifter frame for pivotable movement about an axis parallel to one side of said lifter frame, at least one suction holder and a workpiece stop being disposed on said separator frame adjacent one side of the uppermost workpiece in the stack, said workpiece stop being spaced inwardly from said one side and said at least one suction holder, said at least one suction holder being movable vertically relative to said separator frame to a position above the lower surface

of said workpiece stop to effect bending of the workpiece about said stop;

(b) drive means for pivoting said separator frame upwardly relative to said lifter frame to bend the one side of the workpiece upwardly; and

(c) conduit means coupled to said suction holders and adapted to be coupled to a vacuum source to draw air from said suction holders and thereby secure the sheet thereto, said at least one suction holder adjacent said one side being operable to bend the edge portion of the sheet adjacent said one side upwardly from the plane defined by the working surfaces of others of said suction holders spaced further inwardly from said one side.

2. (currently amended) In a sheet lifter and separator for lifting and separating the uppermost sheet of a stack of workpieces from the sheet disposed therebelow, the combination comprising:

(a) a lifter including a frame and a multiplicity of suction holders spaced thereabout with working surfaces at their lower ends to engage the sheet, and a separator frame pivotably mounted on said lifter frame for pivotable movement about an axis parallel to one side of said lifter frame, at least one suction holder and a workpiece stop being disposed on said separator frame adjacent one side of the uppermost workpiece in the stack, said workpiece stop being spaced inwardly from said one side and said at least one suction holder, said at least one suction holder being movable to a position above the lower surface of said workpiece stop;

(b) drive means for pivoting said separator frame relative to said lifter frame; and

(c) conduit means coupled to said suction holders and adapted to be coupled to a vacuum source to draw air from said suction holders and thereby secure the sheet thereto, said at least one suction holder adjacent said one side being operable to bend the edge portion of the sheet U adjacent said one side upwardly from the plane defined by

spaced further inwardly from said one side, said at least one suction holder adjacent said one side includes at least a first suction holder spaced at a first close distance from said one side and a second suction holder spaced at a second greater distance inwardly from said one side, each of said suction holders having a suction holder sleeve provided on a suction holder base, said suction holder sleeve of said one suction holder being compressible to a greater extent than that of said second suction holder by the vacuum applied in the direction of the workpiece surface, said differential in compression producing a differential in the vertical spacing of said first suction holder from said working surface.

3. (previously amended) A sheet lifter and separator in accordance with Claim 2 wherein said suction holder sleeves are of a bellows-type configuration provided by multiple folds with said one suction holder having a greater number of folds than the sleeve of said second suction holder.

4. (previously cancelled)

5. (previously amended) A sheet lifter and separator in accordance with Claim 1 wherein said at least one suction holder is uncoupled from other holders placed on the outermost workpiece in the stack.

Claims 6-8 (Cancelled)

9. (previously amended) A sheet lifter and separator in accordance with Claim 1 wherein there are included at least one separator nozzle mounted on said lifter frame adjacent said one side and a conduit connected thereto and adapted to be coupled to a source of pressurized air, whereby pressurized air can be released in the direction of the edge of the workpieces to facilitate separation of the uppermost sheet.

10. (Original) A sheet lifter and separator in accordance with Claim 9 including means for releasing the pressurized air in pulses.

11. (previously amended) A sheet lifter and separator in accordance with Claim 9 wherein there are a multiplicity of separator nozzles in staggered relationship along the one side of the lifter frame assigned to the suction separators.

12. (Currently amended) A sheet lifter and separator for lifting and separating the uppermost sheet of a stack of workpieces from the sheet disposed therebelow comprising:

(a) a lifter including a frame and a multiplicity of suction holders spaced thereabout;

(b) a separator frame along one side of said lifter frame and including a frame having an end spaced from said one side of said lifter frame and pivotably mounted on said frame for pivotal motion about an axis parallel to said one side of said lifter frame between a horizontal position parallel to said lifter frame and a position angled upwardly, said separator frame supporting a multiplicity of separator suction holders at positions adjacent said one side and spaced therefrom, a workpiece stop on said separator frame spaced inwardly from said one side of said lifter frame and from at least one of said suction holders on said separator frame, said one suction holder being movable vertically relative to said separator frame to a position above the lower surface of said workpiece stop to effect bending of the workpiece about said stop, said lifter suction holders and said separator suction holders having nozzles with working surfaces at their lower ends;

(c) conduits extending from said suction holders and adapted to be connected to a vacuum source;

(d) drive means for moving said lifter frame upwardly and downwardly relative to a stack of workpieces disposed therebelow; [and]

(e) drive means for pivoting said separator frame upwardly relative to said separator frame to bend the one side of the workpiece upwardly; and

(f) control means for the vacuum source and drive means; and

(g) control means operative to move said holder frame downwardly to a position in which said lifter suction holders thereon grip the topmost sheet of the stack and lift it upwardly, said control means also being operative to bring the separator suction holders against the topmost sheet and engage the sheet adjacent said one side and thereafter to pivot the separator frame upwardly to vary the vertical position of the nozzles of said at least one said separator suction holders relative to the position of the nozzles of said lifter suction holders to bend the one side of the topmost sheet and cause the one side of the topmost sheet to separate from the sheet adhered to its lower surface.

13. (Currently amended) A sheet lifter and separator for lifting and separating the uppermost sheet of a stack of workpieces from the sheet disposed therebelow comprising:

(a) a lifter including a frame and a multiplicity of suction holders spaced thereabout;

(b) a separator frame along one side of said lifter frame and including a frame having an end spaced from said one side of said lifter frame and pivotably mounted on said frame for pivotal motion about an axis parallel to said one side of said lifter frame between a horizontal position parallel to said lifter frame and a position angled upwardly, said separator frame supporting a multiplicity of separator suction holders at positions adjacent said one side and spaced therefrom, a workpiece stop on said separator frame spaced inwardly from said one side of said lifter frame and from at least one of said suction holders on said separator frame, said one suction holder being movable vertically to a position above the lower surface of said workpiece stop to effect bending of the workpiece about said stop, said lifter suction holders and said separator suction holders having nozzles with working surfaces at their lower ends, said suction holders on said separator include said at least one suction holder spaced at a first close distance to said one side and a

second suction holder spaced at a second greater distance each of said suction holders having a suction holder sleeve provided on a suction holder base, said suction holder sleeve of said at least one separator suction holder being compressible by the vacuum to a greater extent than that of said second holder to provide a differential in vertical height to said working surfaces;

(c) conduits extending from said suction holders and adapted to be connected to a vacuum source;

(d) drive means for moving said lifter frame upwardly and downwardly relative to a stack of workpieces disposed therebelow;

(e) drive means for pivoting said separator frame upwardly relative to said separator frame to effect bending; and

(f) control means for the vacuum source and drive means; and

(g) control means operative to move said holder frame downwardly to a position in which said lifter suction holders thereon grip the topmost sheet of the stack and lift it upwardly, said control means also being operative to bring the separator suction holders against the topmost sheet and engage the sheet adjacent said one side and thereafter to pivot the separator frame upwardly to vary

the vertical position of the nozzles of said at least one
said separator suction holders relative to the position of
the nozzles of said lifter suction holders to bend the one
side of the topmost sheet and cause the one side of the
topmost sheet to separate from the sheet adhered to its
lower surface.

14. (Original) A sheet lifter and separator in accordance with Claim 13 wherein said sleeves are of a bellows-type configuration provided by multiple folds with said first holder having a greater number of folds than the sleeve of said second holder.

Cancel Claims 15 and 16

17. (Original) A sheet lifter and separator in accordance with Claim 12 wherein there are included at least one separator nozzle mounted on said lifter frame adjacent said one side and a conduit connected thereto and adapted to be coupled to a source of pressurized air, whereby pressurized air can be released in the direction of the edge of the workpieces to facilitate separation of the uppermost sheet.

18. (Original) A sheet lifter and separator in accordance with Claim 17 including means for releasing the pressurized air in pulses.

19. (Original) A sheet lifter and separator in accordance with Claim 17 wherein there are a multiplicity of separator nozzles in staggered relationship along the one side of the frame assigned to the suction separators.

20. (previously presented) In a sheet lifter and separator for lifting and separating the uppermost sheet of a stack of workpieces from the sheet disposed therebelow, the combination comprising:

(a) a lifter including a frame and a multiplicity of suction holders spaced thereabout with working surfaces at their lower ends to engage the sheet, at least one of said suction holders being disposed adjacent one side of said frame and thereby of the uppermost workpiece, said at least one holder adjacent said one side including at least a first holder spaced at a first close distance to said one side and at least a second holder spaced at a second greater distance inwardly from said one side, each of said suction holders having a suction holder sleeve provided on a suction holder base, said suction holder sleeve of said at least one holder being compressible to a greater extent than that of said at least second holder by the vacuum applied in the direction of the workpiece surface, said differential in compression producing a differential in the vertical spacing of said at least one suction holder from said working surface; and

(b) conduit means coupled to said holders and adapted to be coupled to a vacuum source to draw air from said holders and thereby secure the sheet thereto, said at least one holder adjacent said one side being operable to bend the edge portion of the sheet adjacent said one side upwardly from the plane defined by the working surfaces of others of said holders spaced further inwardly from said one side.

21. (previously presented) A sheet lifter and separator for lifting and separating the uppermost sheet of a stack of workpieces from the sheet disposed therebelow comprising:

(a) a lifter including a frame and a multiplicity of suction holders spaced thereabout;

(b) a separator frame along one side of said lifter frame and including a frame having an end spaced from said one side of said lifter frame and pivotably mounted on said frame about an axis parallel to said one side of said lifter frame for pivotal motion between a horizontal position parallel to said lifter frame and a position angled upwardly, said separator frame supporting a multiplicity of separator suction holders including at least suction holder adjacent said one side and others spaced therefrom, said lifter holders and said separator suction holders having nozzles with working surfaces at their lower ends, each of said holders having a suction holder sleeve provided on a suction holder base, said suction holder sleeve of said at least one suction holder being compressible by the vacuum to a greater extent than that of another holder spaced inwardly therefrom to provide a differential in vertical height to said working surfaces;

(c) conduits extending from said suction holders and adapted to be connected to a vacuum source;

(d) drive means for moving said lifter frame upwardly and downwardly relative to a stack of workpieces disposed therebelow and said control means operative to move said holder frame downwardly to a position in which said lifter holders grip the topmost sheet of the stack and lift it upwardly, said control means also being operative to bring the separator holders against the topmost sheet and engage the sheet adjacent said one side and thereafter to pivot the separator frame upwardly to vary the vertical position of the nozzles of said separator holders relative to the position of the nozzles of said lifter holders to bend the one side of the topmost sheet and cause the one side of the topmost sheet to separate from the sheet adhered to its lower surface;

(f) drive means for pivoting said separator frame;
and

(g) control means for the vacuum source and drive means.